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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/643,062	08/18/2003	John R. Richards	4094-009	4152
24112	7590	01/31/2006	EXAMINER	
COATS & BENNETT, PLLC P O BOX 5 RALEIGH, NC 27602			WONG, EDNA	
			ART UNIT	PAPER NUMBER
			1753	
DATE MAILED: 01/31/2006				

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/643,062

Applicant(s)

RICHARDS ET AL.

Examiner

Edna Wong

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 December 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4 and 6-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4 and 6-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

This is in response to the Amendment dated December 19, 2005. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The **finality** of the rejection of the last Office Action has been withdrawn in view of the new grounds of rejection.

Response to Arguments

Claim Rejections - 35 USC § 112

Claims **1-4, 6-11 and 14** have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The rejection of claims 1-4, 6-11 and 14 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 103

Claims **1-4 and 6-11** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Stevens** (US Patent No. 4,416,748).

The rejection of claims 1-4 and 6-11 under 35 U.S.C. 103(a) as being unpatentable over Stevens has been withdrawn in view of Applicants' remarks.

Allowable Subject Matter

The indicated allowability of claims 12-18 is withdrawn in view of the new grounds of rejection. Rejections based on the new grounds follow.

Claim Rejections - 35 USC § 112

Claims **6 and 7** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 6

lines 2-3, it appears that the “free radicals” are the same as those recited in claim 1, line 4. However, it is unclear if they are. If they are, then it is suggested that the word -- the -- be inserted after the word “form”.

Claim 7

lines 2-3, “prior to irradiating of the gas stream to form the free radicals that react with the ammonia in the gas stream” lacks antecedent basis.

Claim 1, line 2, recites “***irradiating the gas stream*** with UV light”.

Claim 1, lines 4-5, recites “forming ***free radicals that remove a hydrogen atom from the ammonia*** to form NH₂”.

This claim limitation in claim 7 combines two separate steps that are unrelated in claim 1. Claim 1 never recites that the irradiating step and forming step are the same or

even combined.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims **1-3, 7-8 and 10-11** are rejected under 35 U.S.C. 102(b) as being anticipated by **Stevens** (US Patent No. 4,416,748).

Stevens teaches a method for removing ammonia ($\text{NH}_3 \rightarrow \text{NH}_2 + \text{H}$) [col. 1, line 15] from a gas stream (= flue gases) comprising:

(a) irradiating the gas stream with UV light (col. 1, lines 10-12);

(b) maintaining a NO_x concentration in the gas stream at a concentration level sufficient to maintain in the gas stream an active set of free radical chain reactions (= sensors are located in the duct and in the stack, the former sensors being responsive to the concentrations of SO_2 and/or NO_x and serving to increase the rate of addition of NH_3 as the concentrations of SO_2 and/or NO_x increase (col. 5, line 60 to col. 6, line 2). This teaching would have suggested to one having ordinary skill in the art that the NO_x concentration in the gas stream was maintained at a concentration level. This concentration level would have been sufficient to maintain in the gas stream an active set of free radical chain

reactions ($\text{NH}_2 + \text{NO} \rightarrow \text{N}_2 + \text{H}_2\text{O}$ and $\text{NH}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$) [col. 1, lines 16-25] because the process is continuous (= the process is applied to a flowing stream of the gas) [col. 1, lines 39-40]);

(c) forming free radicals (col. 2, lines 12-23 and lines 63-68; and col. 3, Table 1) that remove a hydrogen atom from the ammonia to form (*inherent*); and (d) reacting the NH_2 with NO_x to form N_2 and H_2O (col. 1, lines 16-25).

The NO_x includes NO and NO_2 (col. 1, lines 16-25) and wherein the NO_2/NO concentration ratio is maintained generally at a value of less than 10 (*inherent*).

A set of free radicals formed to react with the ammonia is derived from nitrogen oxides, carbon monoxide, hydrocarbons, and water vapor (= when the mixture is irradiated with the UV light in the wavelength range of about 170 to about 190 nm, NO_x continues to be removed by amino radicals as a result of reactions (1), (2), and (3). Additionally, below about 190 nm there is considerably formation of OH radical due to photolysis of water vapor which is present as a matter of course in flue gas streams) [col. 2, lines 12-23 and lines 63-68; and col. 3, Table 1].

The gas stream includes an initial NO_x concentration upstream from the location where the gas stream is irradiated and a succeeding NO_x concentration at or down stream from the area where the gas stream is irradiated (col. 7, lines 20-26; and Fig. 1).

The method further comprises removing particulate matter (= electrostatic precipitator) from the gas stream prior to irradiating the gas stream to form the free radicals that react with the ammonia in the gas stream (col. 5, lines 35-40; and Fig. 1).

The intensity of the irradiation falls in the range of 100-2,000 microwatts per square centimeter (= about 10^{18} to 10^{19} photon/cm²) [col. 7, lines 29-33].

Disassociated hydrogen atoms form H₂O and hydroperoxy free radicals, and wherein the formed hydroperoxy free radicals continue to initiate oxidation reactions involving ammonia (*inherent*) [col. 1, lines 13-25, Equations (1), (2) and (3)].

Disassociated atoms form H₂O and hydroperoxy free radicals (*inherent*) [col. 1, lines 13-25, Equations (1), (2) and (3)].

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

I. Claims **4, 6 and 9** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Stevens** (US Patent No. 4,416,748) as applied to claims 1-3, 7-8 and 10-11 above.

Stevens is as applied above and incorporated herein.

The method of Stevens differs from the instant invention because Stevens does not disclose the following:

a. Wherein the succeeding NO_x concentration is at least 50% of the initial NO_x concentration, as recited in claim 4.

Stevens teaches that percentage reductions of NO_x that will be required

in any given case will depend on the initial concentrations of NO_x present in the flue gas and the levels of NO_x concentration that is desired to achieve in stack gas passed to the atmosphere (col. 7, lines 20-26).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the succeeding NO_x concentration described by Stevens to wherein the succeeding NO_x concentration is at least 50% of the initial NO_x concentration because the succeeding NO_x concentration is a variable that would have depended on what one having ordinary skill in the art would have desired to achieve in stack gas passed to the atmosphere.

Furthermore, this is well within one having ordinary skill in the art dependent upon the environment to which the exhaust stream will pass which would be most suited for the safety of the environment, absent evidence to the contrary.

b. Irradiating the gas stream with UV light in the spectral range of 230 to 370 nanometers to form free radicals that react with the ammonia, as recited in claim 6.

Stevens teaches that desirably, the radiation includes at least one component with a wavelength in the range of about 180 to 270 nm. There is some tendency during the present reaction for combination of NH₂ radicals to occur, yielding hydrazine which is poisonous, $\text{NH}_2 + \text{NH}_2 \rightarrow \text{N}_2\text{H}_4$. Hydrazine is a strong absorber of radiation in the wavelength range about 180 to about 270 nm, and dissociates to reform the amino radical, $\text{N}_2\text{H}_4 + h\nu \rightarrow 2 \text{NH}_2$. By employing a source of ultraviolet light

including one or more components in the wavelength range 180-270 nm, the content of hydrazine in the reaction mixture can be kept to acceptably low levels by its re-conversion to free NH_2 radicals (col. 4, lines 11-34).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Stevens by irradiating the gas stream with UV light in the spectral range of 230 to 370 nanometers to form free radicals that react with the ammonia because the content of hydrazine in the reaction mixture would have been kept to acceptably low levels by its re-conversion to free NH_2 radicals as taught by Stevens (col. 4, lines 11-34).

The reason or motivation to modify the reference may often suggest what the inventor has done, but for a different purpose or to solve a different problem. It is not necessary that the prior art suggest the combination to achieve the same advantage or result discovered by the Applicants. *In re Linter* 458 F.2d 1013, 173 USPQ 560 (CCPA 1972); *In re Dillon* 919 F.2d 688, 16 USPQ2d 1897 (Fed. Cir. 1990), *cert. denied*, 500 US 904 (1991); and MPEP § 2144.

c. Filtering particulate matter from the gas stream and providing a two-stage irradiation process where one irradiation stage is employed prior to filtering the particulate matter and the second irradiation stage is employed after filtering the particulate matter, as recited in claim 9.

It would have been obvious to one having ordinary skill in the art at the time the

invention was made to have modified the method described by Stevens by filtering particulate matter from the gas stream and providing a two-stage irradiation process where one irradiation stage is employed prior to filtering the particulate matter and the second irradiation stage is employed after filtering the particulate matter because the repetition of steps to provide the same results is well within the skill of one having ordinary skill in the art. The concept of duplication is not patentable. *St. Regis Paper Co. v. Bemis Co. Inc.*, 193 USPQ 8, 11 (7th Cir. 1977). While this decision relates to the duplication of parts, there is no reason why such duplication cannot be extended to a process step.

Furthermore, Stevens teaches one irradiation stage employed prior to filtering the particulate matter (Fig. 1a) and one irradiation stage employed after filtering the particulate matter (Fig. 1).

II. Claims **12-18** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Stevens** (US Patent No. 4,416,748) in combination with **Kupper et al.** (US Patent No. 5,219,544)

Stevens is as applied for reasons as discussed above and incorporated herein.

The method of Stevens differs from the instant invention because Stevens does not disclose the following:

a. directing a raw feed into a pyroprocessing system of a cement manufacturing facility, and heating the raw feed as the raw feed moves through the pyroprocessing

system;

b. directing the heated raw feed through at least one kiln that forms a part of the pyroprocessing system to produce cement clinker; and

c. heating the pyroprocessing system and directing the resulting gas stream through the pyroprocessing system, as recited in claim 12.

Stevens teaches that the photolysis reaction may be applied to all flue gases obtained from conventional combustion processes (col. 9, line 65 to col. 10, line 8).

Like Stevens, Kupper teaches the reduction of the content of SO₂ and/or NO_x in flue gas. Kupper teaches that the flue gas is an exhaust gas from plants for the production of cement clinker. The exhaust gas frequently contains in addition to NO_x, NH₃, SO_x, HCl as well as heavy metals and trace pollutants which can lead to emission problems (col. 1, lines 58-64). The plant for the production of a cement clinker contains a preheater 1 which serves for preheating and at least partial deacidification of the raw material and a rotary kiln 2 which serves for final burning of the preheated and deacidified material (col. 5, lines 46-65; and Fig. 1).

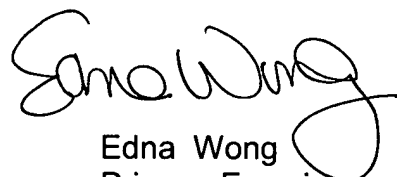
It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Stevens by directing a raw feed into a pyroprocessing system of a cement manufacturing facility, and heating the raw feed as the raw feed moves through the pyroprocessing system; directing the heated raw feed through at least one kiln that forms a part of the pyroprocessing system to produce cement clinker; and heating the pyroprocessing system and directing the

resulting gas stream through the pyroprocessing system because when the photolysis reaction is applied to a flue gas obtained from a conventional combustion process such as the production of cement clinker, the plant for the production of the cement clinker would have contained a preheater **1** which serves for preheating and at least partial deacidification of the raw material and a rotary kiln **2** which serves for final burning of the preheated and deacidified material as taught by Kupper (col. 5, lines 46-65; and Fig. 1), and thus, steps (a), (b) and (c) would have been carried out.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 4:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Edna Wong
Primary Examiner
Art Unit 1753

EW
January 11, 2006